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Corporate governance and firm performance in new technology ventures

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Abstract

This paper studies the relationship between the features of managerial board, ownership structure and firm performance of a particular type of new technology ventures: the academic spin offs. These are mainly small and medium firms, focused on high technology, research and innovation, that involve private and public actors in their ownership structure. Literature shows that these firms play an important role for economic growth of a country, however in Italy a high degree of academic spin offs doesn't survive for a long time. Managerial competences, corporate governance attributes and financial structure could explain these phenomenon. This study observes a sample of Italian academic spin offs established in the last five years: primary data on corporate governance, industry, ownership structure, financial aspects are taken from the National Register of Firms, University (parent organization) and company website. Statistics show relevant relations between firm performance and corporate governance attributes and confirmed, after the start-up, the inefficiency of the board of directors in which there is an overlapping between academic-founder and manager, suggesting greater openness to outside expertise.

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Keywords: academic spin off; CEO duality; ownership structure; firm performance.

1. Introduction

Composition, managerial style and competences are important elements for the efficiency of managerial board and for the firm performance. During the last decade, research on corporate governance shown that the real problem, for a good governance practice, is linked more to the access to critical resources that to agency conflicts between

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ownership and management (Van Gils, 2005; Roe 1994). Strategic and managerial competences of CEO, financial resources and partnerships are strategic for the development of the firms (James, 1999; Bianco and Casavola, 1999), especially in those contexts where competitiveness is based upon knowledge and innovation and where capital markets are not very developed and not very dynamics. In knowledge-intensive sectors, also attribute of corporate governance may represent critical resources, able to influence the firm performance and its survival (Renders et al, 2010). For this reason designing the structures of governance, the primary goal becomes searching for more effective solutions to engage stakeholder who bring expertise, critical know-how, financial resources and strategic relations (Rajan and Zingales, 2000). Small and medium enterprises are the most representative firm model in Italy, where the corporate governance structure presents a high degree of ownership concentration, CEO duality and overlapping between manager and founder. These features reduce the agency problems, but bring out the need to have extensive knowledge and expertise, in order to have a rapid, efficient and flexible decision-making process, considering the actual challenges of enterprises, especially within dynamic sectors. Based on resource dependency theory (Pfeffer and Salancik, 1978), this study analyzes a particular type of SME: the academic spin offs. These are technology or research-based ventures, that involve private and public actors in their ownership structure, where there is often an overlap between the roles of founder, manager and academic researcher, who continues to carry out its research activities within the university, reconciling with great difficulty the managerial duties. This research focuses on the relations between the corporate governance features and the economic performance of academic spin-offs after the start-up phase, when management expertise and research funding are crucial for the development of these firms and, consequently, for their survival. The structure of the paper is as follows: in section 2 we describe the features of academic spin off; in section 3 we present the role of corporate governance in ASOs and we develop the hypotheses of this study; in section 4 we present the research model, variables and sample; in section 5 we show the empirical results and then we discuss the main finding and draw some conclusion.

2. Academic spin off

Academic spin-off (ASO) is a specific type of new technology venture, that involve stakeholders and resources of both public and private nature and which are given the ambitious function of promoting local development by national research policies. Some authors identify a spin-off as the result of a parent organization active in research and development, such as Universities, University Research Centres, laboratories and private research organizations (Wright et al., 2007). ASO is an autonomous structure, nor a subsidiary of the parent organization, that exploit knowledge produced by academic research in a profit perspective, excluding non-profit organizations (Pirnay et al., 2003 Shane, 2004). These firms, in contrast to others original start-ups, represent an innovative way of transfer of research results to a productive and independent business (Robert and Malone, 1996), in which university provides, in the start-up phase, specialized services, expertise, technical equipment, financial resources. Others authors define academic spin-off as a company that was born from researchers that aims to broaden their skills and abilities through the development of research within the university environment (Conti et al., 2010) and that, for these reason, may involve in the ownership structure the university with a minority equity stake. Some authors (Fryges and Wright, 2014) distinguish between pure academic spin off and a hybrid type: pure ASO includes only academic founders that continue to work part-time for the university (parent organization), while in the hybrid type the team of founders includes university researchers and outsiders with entrepreneurial experience. In some cases the founder-researcher left the university for the private-profit activity and this is considered a potential career path for the researcher; in other case, spin offs creation is a strategic milestone for the career path within the academic context. These motivations affect on the firm performance and on the survival rate of ASOs, together with the business model of these ventures. Literature distinguishes the product-oriented spin offs from research spin offs as a subcategory of new technology ventures and makes a distinction between firms able to attract management capabilities in the founding team and firms founded by individual researchers. In this last case, the managerial style and the objectives are the results of personal interests of academic inventor, who wants, first of all, to complete their research project and to increase their independence within scientific community. Grandi and Grimaldi (2005) show that market orientation and managerial competences of founders are determinants for a successful industrial innovation, especially when the business idea don't come from the market, but from the availability of scientific and

technological knowledge (Schmookler, 1966; Rothwell, 1992). Stankiewicz (1994) defines the research based spin offs mainly service firms, while the technology spin offs were more product oriented or addressed to sold their technologies through licences. In the first case, some studies show that most ASOs tend to be mostly individual enterprises or SMEs and, in different European countries, these firms don't grow (Autio and Lumme, 1998, Chiesa and Piccaluga, 2000, Wtterwulghe, 1998). Different conditions can explain the low degree of growth: sometimes the business idea is linked to a weak technology or a contingent research, that make difficult to identify different applications useful for the market; some business are not able to attract financial resources, especially the venture capitalists, who don't prefer to invest in companies where the managerial team is formed only by researchers without business experience (Mustar et al., 2006); often ASOs tend to establish scientific collaborations that don't contribute to sales growth and to business idea development. In Italy, about the 80% of ASOs was born during the last decade (Piccaluga and Balderi, 2007), but most of them show criticisms in term of growth, survival and competitiveness (Piccaluga and Balderi, 2006; Netval, 2012; Corsi and Di Berardino, 2013). For this reason academic entrepreneurs, in order to obtain strategic resources and missing competences, establish interactions with external stakeholders, though their personal scientific collaborations and the involvement within the managerial board or in the ownership structure (Grandi and Grimaldi, 2003). Important stakeholders are the universities, that play the role of parent organization, industrial and market partnerships, scientific networks, customers, venture capitalists and other investors. An important challenge for ASO is to manage uncertainties and costs related to the acquisition of crucial resources from the environment and corporate governance structure could reduce the problem of access to strategic resources. Some studies show, in fact, that the improvement of business performance depends on the central position of the enterprise within a network of managers (Zona and Gnan, 2009); this network results from the capacity of the enterprise to organize its relations according to the dependencies started in the past. This phenomenon is, however, examined making often reference to the combinations between industries and credit institutions, considering as critical the dependency on financial resources only (Grandi and Grimaldi, 2003).

3. The role of corporate governance structure within ASO

The debate on the successful factors of ASOs is very broad. Conventionally, knowledge is the main resources together with financial funding and instrumental assets. Few studies observe corporate governance as a critical resource, considering that issue irrelevant, given that in ASOs there is often the overlap between ownership and control that reduce the agency problems and that these ventures don't expose themselves to financial markets. Within ASO the academic inventor is the main shareholder and, considering his financial ties and the higher risk assumed, he is also responsible for managing the company. In this process, however, the inventor combines business activity with the academic role, managing simultaneously scientific and business relations. This requires different skills, ranging acquired by inserting in the board of directors also outside managers, university administrative staff, professionals with long managerial experience, delegates of institutional investors. Therefore, in ASOs the governance structure evolve over time, so as to enable the enterprise to gain access to critical resources and to involve them in the managerial board. According to *resource dependence theory* (Pfeffer and Salancik, 1978), in this study we emphasize the role played by the composition of managerial board for the access to the resources missing within the firm, considering that in Italy financial markets are not dynamic of and this situation obliges the enterprises to establish strong ties with specific external stakeholders. The management skills are essential in order to promote the business growth and the competitiveness. Financial partners, other firms and faculty members are the critical suppliers that academic inventor involve in the ownership structure of ASO and, sometimes, in the board of directors. Stakeholders that give unique and irreplaceable resources may influence the decision-making process and the firm performance and for these reasons they must have the right to govern the enterprise and must take responsibility for negative performance. Governance problem is attract for a long time a team of strategic stakeholders, creating corporate governance structure able to manager different interests: academic founders, university, commercial partners, managers, investors. Within ASOs, the academic inventor assure the core competences in the first stage of entrepreneurial process; however the development of ASOs in new markets requires specific strategic skills and financial resources. The funding gap is often exceeded by inserting institutional investors within the ownership structure, but if there is a strategic gap, then comes the need to involve outsider managers on the board of directors, redefining the structure of the managerial team, in order to make it more

efficient and free up the academic-inventor from managerial issue, engaging him only on scientific activities. However, in Italian SMEs we find often the CEO duality practice, in which the owner serving both as a firm's CEO and board chair. Literature disagrees on the effect of CEO duality on company performance: researches based on agency theory show a negative impact of this unity of power (Rechner and Dalton, 1991); stewardship theory argues that CEO duality improve decisions and the performance (Donaldson and Davis, 1991) Other authors argues that there is no relation between CEO duality and firm performance (Baliga et Al., 1996, Dalton et al., 1998). Boyd (1995) suggests that CEO duality is important in presence of resource scarcity and environmental dynamism, in which the concentration of power is crucial to attract for a long time investors, outside manager, scientific partner. Generally, a firm which practices CEO duality has a smaller percentage of outside directors, but is more likely to have an assertive board with a substantial presence of outside managers (Finkelstein and D'Aveni, 1994). Other important variables to explain the relation between corporate governance and firm performance are the size of board and the presence of women. Some authors (Hillman et al., 2000) argues that women into the board give a broader view of business issues, more inclusive of social and relational issues. Moreover, women has a more participatory and democratic management style, that improves the communication and makes it more efficient the decision-making, especially when it involves different managers. About the size of the board, some studies suggest that with a few board members are more efficient because it reduces the agency problems but these board are inefficient when the company wants to grow, and thus lack the necessary skills. According with this assumption, the characters of the ownership structure could explain how the academic inventor aims to close the skills gap without sacrificing its power. Given these remarks, we can formulate the following hypothesis:

Hp1) there is a negative relations between CEO duality and the performance of ASO;

Hp2) there is a negative relations between the presence of academic-founder into the board of director and firm performance;

Hp3) there is a positive relations between the presence of outside managers into the board of director and firm performance;

Hp4) there is a positive relations between a mixed ownership structure (academic founder, parent organizations, enterprises, venture capitalists..) and firm performance.

4. Research Model: methodology, sample and variables

This research analyses a sample of Italian ASOs established in 2010, taken from the database of National Network of Italian Academic Spin Offs and Patents (Netval). This analysis considers the performance after the start-up phase, when generally spin off fail. Data were collected through documental analysis referred to 2015 and the content analysis approach: information related to business performance and corporate governance was obtained from the national register of Italian companies (Infocamere), from company website and form the national minister of research and university (MIUR); data related to economic and financial performance has been extracted from AidaBvdep system. Initially the analysis extracted 80 firms, but 13 has been cancelled, therefore the final sample of all Italian ASOs established in 2010 and active actually includes only 67 firms. Bivariate Correlation Analysis using Pearson's coefficient and other descriptive statistics have been used to process the variables. Firm performance was measured through the most important accounting-based performance indexes, obtained from the annual report in the period 2014: economic performance refers some important profit margin and the ability of firm to extract value from commercial activities (ROS), from investments into the main business (ROA) and the final profitability (ROE); financial structure has been measured by leverage ratio and the Net financial position (NFP). Variables related to the governance features (Table1) include the ownership structure, the composition of the board of directors, CEO duality and the distribution of the power from the academic-inventor to outside managers, measured through a dummy variable referred to the presence of academic inventor as chair of the board of directors (1,0). The mixed nature of the ownership structure refer to the presence of different strategic stakeholders such as university (Parentshare) and other firms (Firmshare). A dummy variable capture their presence in the sample. For the board of directors the analysis considers the number of female managers (Wobo), the number of outside managers (Outbo) and the number of academic researcher (sharebo) within the managerial team. Finally, the presence of CEO duality practice was measured through a dummy variable. Control variables related to productivity index, size of the board, the size of the firm, industry, ownership concentration and affiliation have been considered. For the productivity measure the analysis considers the assets turnover ratio (ROCI) used as indicator of efficiency of commercial

activity. For the size of the firm, considering the irrelevant number of employees, the analysis refers this variable only to sales and investments; investments and sales are associated generally to industry, for this reason the study considers the potential discriminant effect of life sciences industry on economic and financial performance. Life sciences sector comprises a science-based business (biology, biotechnology, biomedical research, biochemistry), characterized by enterprises that create a research generally at an early stage of development with a potential market value that will be disclose during the time. This kind of business requires several capital, strong market alliances, specific business skills. However, institutional investors generally prefer invest during the development phase, when the uncertainty decreases. For this reason, this study considers the relation of life sciences industry with the ASOs performance, measuring with 1 the presence of the firm in this sector. Ownership concentration express the power concentration in term of percentage of equity referred to the main shareholder, while the affiliation refers to the presence of subsidiaries of ASO. Table 1 shows these variables

Table 1. Variables.

	Description	Measure
Wobo	Presence of female manager	No.
CEOdual	Presence of CEO duality	1,0
Sharebo	Presence of academic researcher into the board of directors	No.
Outbo	Presence of outside manager	No.
Headac	Presence of academic inventor as chair of the board of director	1,0
Firmshare	Presence of other firms as shareholders	1,0
Parentshare	Presence of university as shareholders	1,0
ROS	EBIT/Sales	Percentage
ROA	EBIT/Assets	Percentage
ROE	Net income/Equity	Percentage
Profit	Net income	Value in Euro
EBITDA	Net operating profit	Value in Euro
NFP	Net financial position	Value in Euro
Leverage	Debts/Equity	Absolute value
ROCI	Revenue/Assets	Absolute value
Industry	Presence of ASO in life science sector	1,0
Firmsize	Volume of investments and volume of sales	Value in Euro
Boardsize	Number of Managers	No.
Ownership	Main equity share	Percentage
Sharesize	Number of shareholders	No.
Affiliated	Presence of ASOs investees in other firms	1,0

5. Results: descriptive statistics and correlations

The final sample presents a homogeneous territorial distribution of ASO: 27 firms are located into the South, 24 in the North area and only 16 in the central area of Italy. Life sciences industry is the most populous (31%), followed by ICT (22%) and the energy-environment applications (13%). Table 2 reports descriptive statistics of the numeric variables. The sample has a high number of firms (88%) in which the academic researchers are present in the board; however, it is observed that more than half of the companies (52%) has an external manager the board of directors. This data confirms the theoretical assumptions: the academic-owner does not give up decision-making and operational roles even when needs further reinforcement of management skills. Analyzing in detail the composition

of the board, on average they are made up of three members, a size very common for SMEs; moreover, even if present in many companies in the sample, the external managers are very few within the board, an average of 1, so as it is reduced the number of women. Specifically, only 31% of firms in the sample involving women in management positions. The ownership structure of the academic spin-off has on average five shareholders, in 42% of cases represented by other firms and 31% from university. This shows that although it has passed the start-up phase, the parent organization maintains its presence and its support for the ASO. University share owner is often modest, this situation confirms that the parent organizations provide support in term of facilities and scientific equipment, technical staff and scientific collaborations, that play a strategic role for the development of ASO. Among the shareholders companies, only in 3 cases appear financial investors such as banks and venture capitalists. This also confirms the findings in the literature: the difficulty of attracting capital where the management is too biased towards the academic component. In such cases, the board presents non-academic managers, as representative of the financial investors. The percentage of spin-off with investments on the equity in other companies is very low (31%), demonstrating the reduced nature of the business network. The anomaly is the fact that these affiliations are often other individual firms of the academic-founder or even family businesses. CEO duality is a common practice within the sample (51%) but even more striking is the presence of the academic-inventor, chair of the board of directors. This role is an expression of the maximum control and power over decision-making and operating activity in the company, therefore its coincidence with the author of the technology transfer through the creation of the company appears to confirm the will to not give up the exercise of power although the academic-inventor continues to hold faculty positions that often make it difficult to combine the two activities. Table 3 presents the value of accounting-based performance measures: data on sales and investments confirm the small and medium size of these firms: turnover is between a minimum of 400 euro to a maximum of 800.000 Euros, only 3 companies detect a turnover of over one million Euros; so too the volume of investments ranging from a minimum of 10.000 euros to a maximum of 800.000 euros, with two cases of over one million Euros. On average, the sample has a negative economic performance, both in terms of net income and EBITDA, confirming the disappointing performance and the difficulty to undertake the growth. Also in terms of financial values the firms have strong imbalances expressed by a high leverage ratio and a negative net financial position, often symptoms of severe liquidity strains even in the short term. In fact, the low turnover of assets shows the difficulties of ASOs to recover gradually investments through revenue.

Table 2 – Descriptive statistics

Variables	Min	Max	Mean	Standard Deviation
Wobo	,00	2,00	,3582	,56946
Sharebo	,00	5,00	1,9403	1,30129
Outbo	,00	6,00	,9104	1,20267
ROS	-11,69	16,93	2,5591	6,26275
ROA	-61,67	61,75	1,5763	15,55832
ROE	-49,62	66,47	5,4292	17,66592
Profit	-164178,25	127705,50	-1747,3769	43095,96043
EBITDA	-150670,25	217443,00	10775,4366	50664,88893
NFP	-476077,00	846122,25	-17499,2052	139446,02997
Leverage	,00	135,00	6,8088	16,71112
ROCI	,00	2,72	,6212	,54788
Assets	32,25	3038511,25	249755,582	458953,44162
Sales	,00	5690238,50	248169,973	796114,70116
Boardsize	1,00	9,00	2,9403	1,84949
Ownership	,00	100,00	48,2687	26,44295
Sharesize	,00	16,00	5,0597	3,30234

Affiliated	,00	2,00	,6134	,46739

Correlation analysis (Table 3) shows a positive relation between CEO Duality practice and the mean value of net income that assume a negative value during the period observed. This situation highlights, therefore, that in presence of CEO duality increases the negative income of ASO (Hp1); there are no significant relations between other performance measures and CEO duality. This practice is negatively correlated to the presence of outside managers, as well as the board size and the ownership structure. The presence of institutional investors, as other companies and venture capitals, in the ownership structure reduces the tendency to concentrate the power in one person, imposing the division of it between the different members of the board. The presence of academic-researchers into the board of directors is positively correlated with the presence of the university, while it is negatively linked to higher rates of ownership concentration of equity. This suggests that where the equity is diluted among a larger number of shareholders, board members open to outside managers. A Board with academic-researchers is negatively correlated to ROS, while is positively related to the volume of investments (Hp2). Also, the presence of women within the board is negatively correlated to ROS. Female managers are more present in larger board. This situation confirms the idea that academics have a generally weak market orientation and its business struggling to find commercial applications. Indeed, outside managers are more present where there are institutional investors, represented by firms and university. Furthermore, the presence of outside managers affected by the specificities of the sector, being positively correlated with the presence of companies belonging to the life sciences industry. This seems logical and confirms the position of literature that considers the external manager gives competence lacking the academic founder, which in the case of life sciences is generally far from the managerial skills. Considering the negative value of the economic performance measures (EBITDA, Profit), the negative relationship between these indicators and the presence of external managers confirms the hypothesis that these parties allow the ASO to achieve better performance (Hp3). More ambiguous is the negative relationship between ROE and outside managers. From the point of view of the consolidation of equity and debt exposure, the statistics confirm that leverage ratio decreases in presence of outside managers. However, this positive impact on financial structure is mitigated considering the low use of outside managers within the sample. Considering the ownership structure, there is a negative relation between mixed structure (parent organization, academic-founder, other firms..) and economic performance measured by ROA and ROE. This situation does not confirm the hp4, belief that management skills are more incisive on the economic performance of ASO, while the ability of attracting institutional investors or to retain the support of its parent organization is not significant. No relationship is found between the mixed ownership structure and financial performance. Ownership concentration is positively linked to leverage and negatively impact on profit margin. Among control variables in presence of larger board there is a negative net operating profit (EBITDA), while is absent the CEO duality practice. Also industry variable negatively affects economic performance, in particular ROE and the turnover of investments through sales (ROCI), which taking negative values for ASOs in the field of life sciences (Table 4), while is related in a positive way to leverage ratio, confirming the literature that assumes the high level of financial resources absorbed in this sectors.

Table 3 – Correlation analysis

		Firmsh	Parentsh	ownership	Boardsize	Wobo	Outbo	Ceodual	Shareb	Headac
Firmshare	Pearson Correlation				,407(**)		,469(**)	-,255(*)		
	Sig. (2-queues)				,001		,000	,037		
	No.				67		67	67		
Parentshare	Pearson Correlation				,554(**)		,486(**)			,466(**)
	Sig. (2-queues)				,000		,000			,000
	No.				67		67			67
Ownership	Pearson Correlation									-,630(**)
	Sig. (2-queues)									,000

	No.									67
Boardsize	Pearson Correlation	,407(**)	,554(**)			,280(*)	,726(**)	-,650(**)		
	Sig. (2-queues)	,001	,000			,022	,000	,000		
	No.	67	67			67	67	67		
Wobo	Pearson Correlation				,280(*)					
	Sig. (2-queues)				,022					
	No.				67					
Outbo	Pearson Correlation	,469(**)	,486(**)		,726(**)			-,399(**)		
	Sig. (2-queues)	,000	,000		,000			,001		
	No.	67	67		67			67		
Ceodual	Pearson Correlation	-,255(*)			-,650(**)		-,399(**)			
	Sig. (2-queues)	,037			,000		,001			
	No.	67			67		67			
Headac	Pearson Correlation									
	Sig. (2-queues)									
	No.									
EBITDA	Pearson Correlation				-,406(**)		-,505(**)			
	Sig. (2-queues)				,001		,000			
	No.				67		67			
Profit	Pearson Correlation			-,309(*)			-,263(*)	,281(*)		
	Sig. (2-queues)			,011			,031	,021		
	No.			67			67	67		
Assets	Pearson Correlation								,622(**)	-,257(*)
	Sig. (2-queues)								,000	,036
	No.								67	67
ROS	Pearson Correlation					-,324(**)			-,350(**)	
	Sig. (2-queues)					,007			,004	
	No.					67			67	
ROA	Pearson Correlation	-,333(**)								
	Sig. (2-queues)	,006								
	No.	67								
ROE	Pearson Correlation	-,341(**)					-,250(*)			
	Sig. (2-queues)	,005					,042			

	No.	67		67
ROCI	Pearson Correlation			-,289(*)
	Sig. (2-queues)			,018
	No.			67
Leverage	Pearson Correlation		,273(*)	-,459(*)
	Sig. (2-queues)		,026	,005
	No.		67	67

** Correlation is significant at level 0,01 (2-queues).
* Correlation is significant at level 0,05 (2-queues).

Tab. 4 Correlation analysis

		Industry
ROCI	Pearson Correlation	-,348(**)
	Sig. (2-queues)	,004
	No.	67
ROE	Pearson Correlation	-,441(**)
	Sig. (2-queues)	,000
	No.	67
Leverage	Pearson Correlation	,321(**)
	Sig. (2-queues)	,008
	No.	67

6. Conclusions

This research proposed to test resource dependency theory to interpret the relationship between corporate governance and firm performance outside of the traditional SMEs, considering the ambiguous nature of ASOs Albeit with limits of the sample, the research findings can respond to different research questions. Results suggest the ambivalent effects of mixed ownership structure with reference to access problems to strategic resources, but confirm that CEO duality and board with academic-researchers do not enhance firm performance, especially the operating profitability. Firms in our sample have the capital concentrated in the hands of few or several researchers linked by scientific ties and strong alliances with their parent organizations that assure their support over the start-up phase. The presence of financial actors, such as venture capitalists, in the social structure is modest, practically absent in the major part of the sample and this phenomenon is linked to board composition. The small size of Italian ASOs can justify the prevailing managerial role of academic-founder in the board, but it is associated to negative performance; however, the presence of outside executive managers in the half of the sample shows that the spin-off have the awareness to elevate managerial skills inserting external managers, accessing external resources and managing the interdependencies with other organizations that financing the spin offs. Critical resources to growth are the managers. In ASOs the corporate governance systems it should be structured on two levels: an organ not necessary the board of directors, that makes up the interests of private and public stakeholders; a body, not necessary the CEO, which manages the business. It could also be individual bodies (CEO, executive managers, academic-founder). At least, two factors influence the effectiveness of the adopted solution: the nature of the stakeholders in the social structure; the degree of complementarity among the managerial skills. To these, this research add the influence of the industrial factors and its competitive dynamics and technology. Therefore, the need to access to

strategic resources, address the ASOs to recombine during the time, the connections with a network of scientific and managerial skills, in order to increase their level of performance. Resource dependency theory appears promising. Future research may consider other performance measure, such as the innovation, revenue from patents and organizational efficiency.

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